GENERAL SERVICES ADMINISTRATION
NATIONAL CAPITAL REGION
WASHINGTON, D.C. 20407

PRELIMINARY STRUCTURAL ASSESSMENT REPORT

DATE: April 21, 2017

PROJECT: Ronald Reagan Building – 14th Street ramps
Investigation of Ceiling Failure at the 14th Street North Vehicle Ramp

Introduction

The Office of Planning & Design Quality (OPDQ) was requested by Tim Turano, Director – Office of Facilities Management on Thursday April 20, 2017 to visit the Ronald Reagan Building and investigate the Ceiling Failure at the 14th North Vehicle Ramp. OPDQ was also forwarded the following email from Tony Overton, Building Manager "At 4:45pm the ceiling and signage superstructure at the top of the ramp exiting the parking garage on the 14th St north side of the building collapsed inexplicably. The superstructure fell on an exiting vehicle (an employee of customs and border patrol). That individual was not harmed as reported by EMS however his car was substantially damaged". Tony Overton also requested an investigation of the 14th Street South and 13 ½ Street Vehicle Ramps. In response to the above requests, GSA Structural Engineer Amit Datta, P.E., Dawit Zena, P.E., Ron Wood P.E., OPDQ Engineering Branch Chief, Donald Battle, Greg Dix and other Ronald Reagan Building management team were present at the site visit. The visit occurred in the morning of Friday April 21, 2017.

Observations:

14th Street North Vehicle Ramp

The OPDQ structural engineers observed during the site visit that the ceiling at the 14th Street North Vehicle Ramp had collapsed at the second panel location by the entrance and adjacent two panels were sagging. The ceiling consists of approximately ¾" thick plaster ceiling panels approximately 10feet wide with a lath back up (Appears to have been done on site due to different colors of coating) connected to 1 ¼"x2 ½" light gage channels spaced at approximately 12 inches on center. The channels are in turn supported by light gage "C" channels spaced at approximately at the third ceiling panel points. The channels are connected to the concrete ceiling soffit above at approximately 4 feet on centers. "Eye" socket hangers or hammer drilled expansion screws (Approximately ¼" diameter by 1-¼" long) provide the hanging mechanism for the wire hangers. At some locations the ceiling panels appear to be directly hung from wires. Light gage tracks attached to the concrete ceiling by the expansion screws at approximately 12" on center provide support for the vertical light gage studs 3 ¾" deep x 1 ¾" flange that act as the framing for the bulkheads.

The ceiling also supported lighting, signage and sprinkler pipes as well as insulation and vapor barrier for the protection of the occupied space above.

Existing building drawings do not provide ceiling support details even though wire hangers seem to have been drawn in. Specifications for the plaster ceilings were not available at this time. Shop drawings for the plaster ceilings, hangers and framing were not available at this time.

14th Street South Vehicle Ramp

The ceiling at the 14th Street South Vehicle Ramp did not have panels that were sagging visibly and of immediate danger of collapsing. However cracks were observed.

No excessive deflection or sagging was observed at the ceilings. However, even though the ceilings show no excessive deflection, the extent of cracks and the fact that a similar ceiling at the north ramp had collapsed poses some risk of structural failure.

13th ½ Street South Vehicle Ramp

The ceiling at the 13th ½ Street South Vehicle Ramp did not have any plaster ceiling panels as the ramp is below an open courtyard slab. Therefore, there were no structural issues.

FINDINGS:

As stated above in the Observations section, the collapsed ceiling at the 14th street north ramp and the pulled out anchor screws that were visually observed indicate a systemic structural failure. The ceiling is supported by hangers acting in tension. Structural calculations could not be performed due to lack of time and unavailability of shop drawings and specifications. It is also highly unlikely that calculations can be performed with a level of certainty since the location of hangers is haphazard in nature.

It appears that there are several probable reasons for this failure:

a. It may be the design of the anchorage system which were holding the ceiling might have been under – designed, if there was any design.
b. The anchorage system was not properly designed - from material and allowable stress point of view. From visual observation of the ramp it gives the impression that the anchorage system was inadequate to support the imposed load.
c. The dead load of the ceiling was too heavy for the anchorage system.
d. Vibration of the ramp concrete slab caused by the automobiles.
e. Quality of the cementitious ceiling did not possess the adequate strength.

The following could be done to Solve/Prevent this problem

a. Investigation of all materials used to manufacture the ceiling should be tested in a reputed/qualified laboratory in order to determine whether they were of adequate strengths.
b. If found from the laboratory tests and theoretical calculations, using the results obtained from the laboratory, that the materials used for the ceiling did not possess the required adequate quality, then these ceilings justify to be eliminated and should be demolished and replaced with new ceilings with appropriate materials and methods.
c. Based on the above information the ceilings which are not damaged but laboratory tests show that they may or may not possess required material properties then these ceilings should be considered to be demolished and replaced with new appropriate methods and materials.

However, the fact that the ceiling has collapsed means that it does not meet current code requirements. Therefore, all ceilings that were of similar construction should be immediately removed or should have temporary shoring immediately installed.

OPDQ will discuss with the architecture and Historic Preservation team if the ceiling could be removed while keeping an insulation system. This would be considered a change and even though an NCPC submission may not be required, proper design is necessary. A re-design of the support system for the ceiling will need to be done if the ceiling system with or without a new design is selected. For this alternative, instead of relying on the wire hangers and tracks at the ceiling slab hanging from "eye" sockets and hammer drilled screws, a light gage rafter system is recommended (See sketches).

OPDQ was informed that the north ramp should be put back in service as soon as possible since it is the access point for delivery trucks. We were also informed that the South ramp cannot completely be closed off.

RECOMMENDATIONS:

Since the findings indicate imminent danger of structural failure of areas that have not collapsed already, either immediate removal of the ceiling panels or shoring is required.

Therefore in order to mitigate this major deficiency the following recommended action should be taken:

1) Keep the 14th Street North Ramp closed off and do not have anyone have access to the area.
2) Remove sagging and loose ceiling at the north ramp. This was verbally communicated to the Building management and contractors and work is assumed to have begun as of 04/21/2017.
3) Immediately set up a daily monitoring protocol for the south ramp to be performed by the building engineers. OPDQ to be informed of any excessive cracks, sagging or any deficiencies in the south ramp ceiling.
4) Remove all ceiling or install temporary shoring under the 14th Street North and South Ramp until repairs are performed.
5) Immediately come up with a temporary shoring design performed by a registered structural engineer if the strengthening option is selected and for the South ramp in order to keep it operational. Since the shoring is supporting ceiling only, a typical pedestrian walkway overhead protection may be used. This could be using 2x12 rafters spaced at 24" on center that get supported by girder beams placed parallel to the two concrete walls and along the two raised median concrete wall or concrete curb. The girder beams may be typical scaffolding beams supported by columns spaced at a 12 feet to 16 feet spacing. Please note that OPDQ has suggested the attached temporary shoring layout for pricing purposes.
6) Engage a structural engineer that can recommend a strengthening of the existing support system or redesign the ceiling and its support system.

7) Conduct a more thorough structural survey to document the as built condition and develop repair requirements if the strengthening option is followed.
8) Engage a design team to recommend a different ceiling system is that alternate is selected.
9) Perform the repair/strengthening or replacement construction work.

The above recommendations would be performed best by a design build contractor or a specialized contractor that has a design professional or firm that has experience in light gage steel and ceiling plaster work.

The following figures show the design drawings for the ramps

The following pictures show the site conditions.

Please feel to contact me if you have any questions.

Sincerely,

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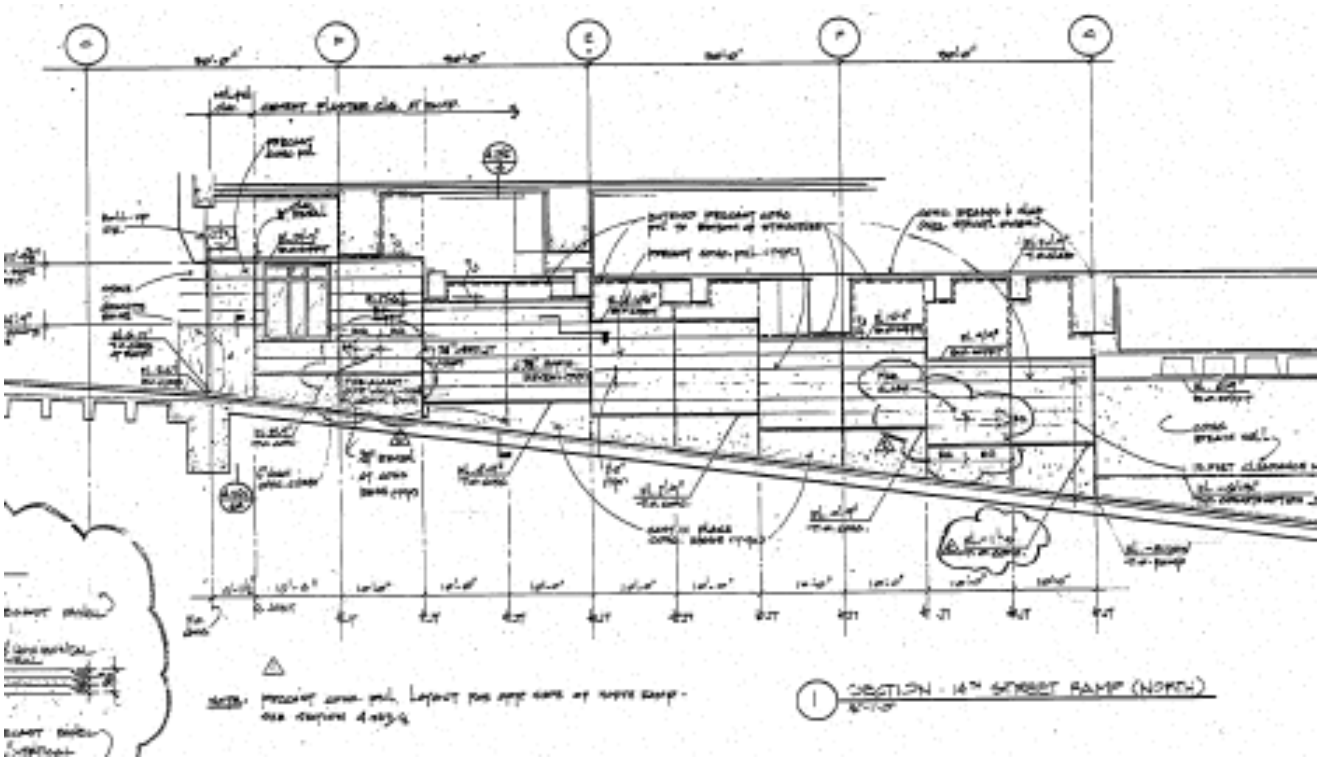

Figure 1: 14th Street North Ramp Section

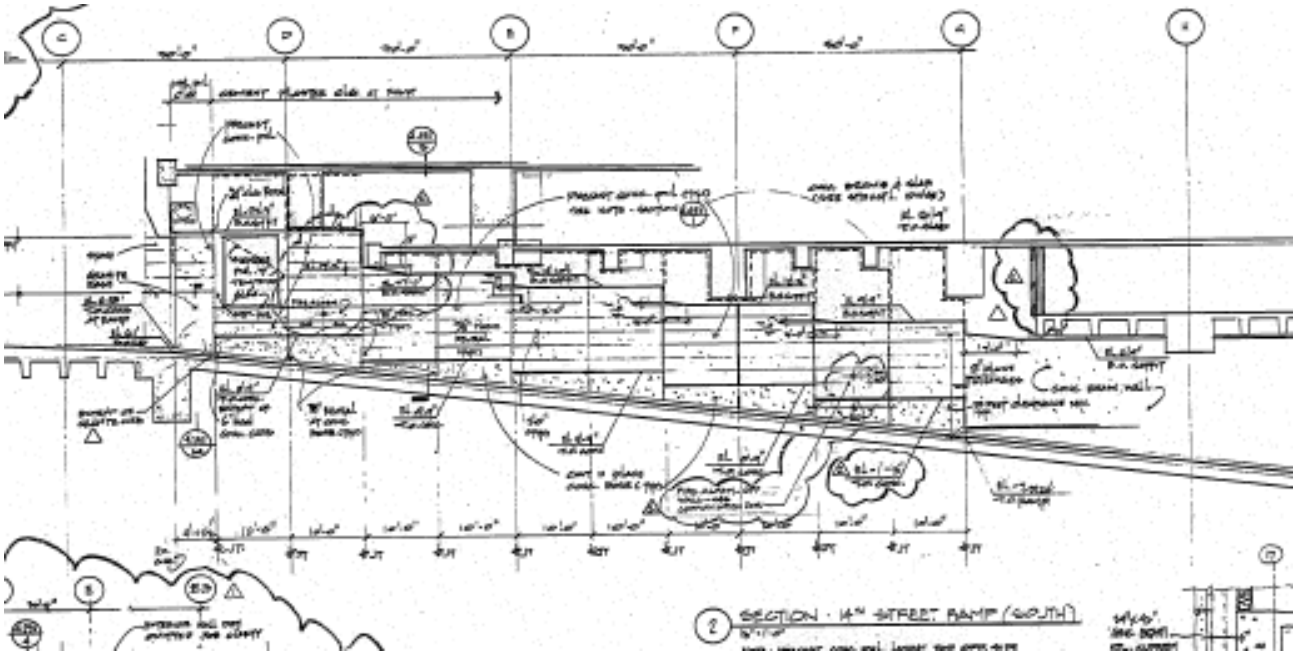

Figure 2: 14th Street South Ramp Section

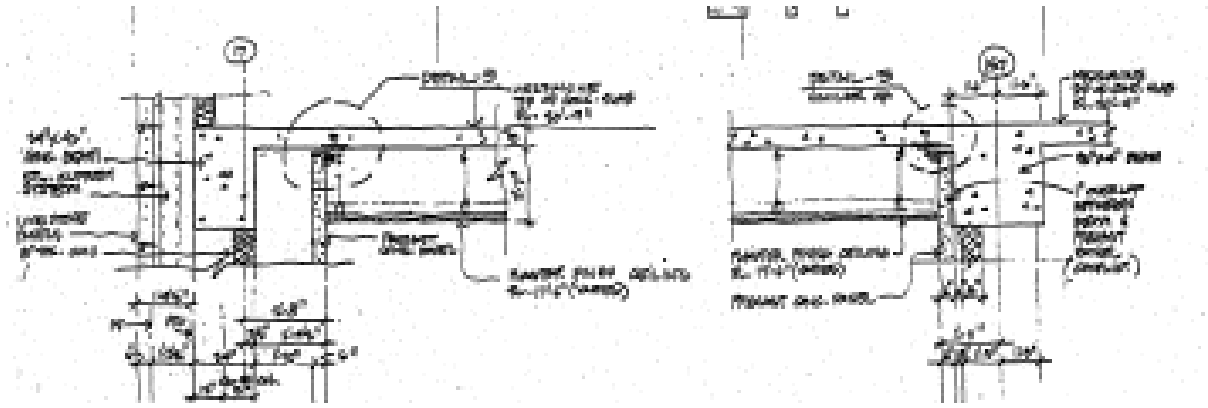

Figure 3: Section showing wire hangers

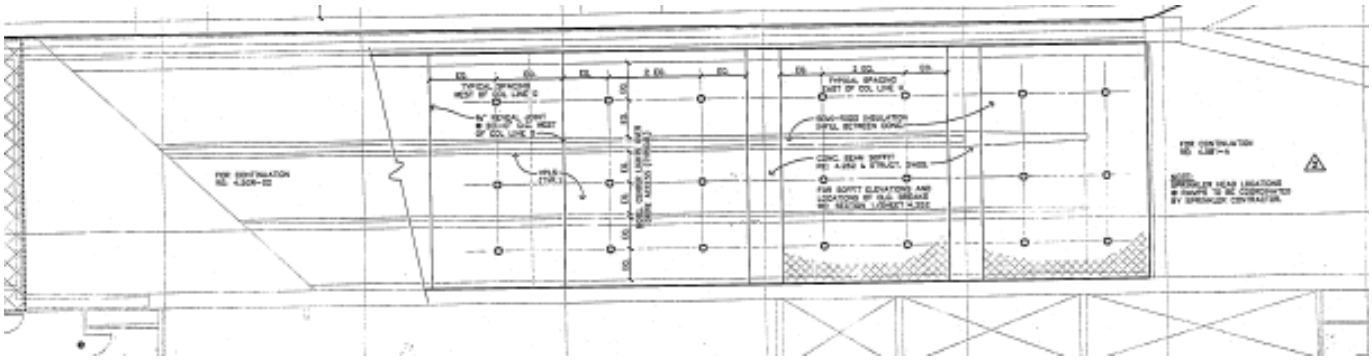

Figure 4: 14th Street North Ramp Reflected Ceiling Plan – B1 Level

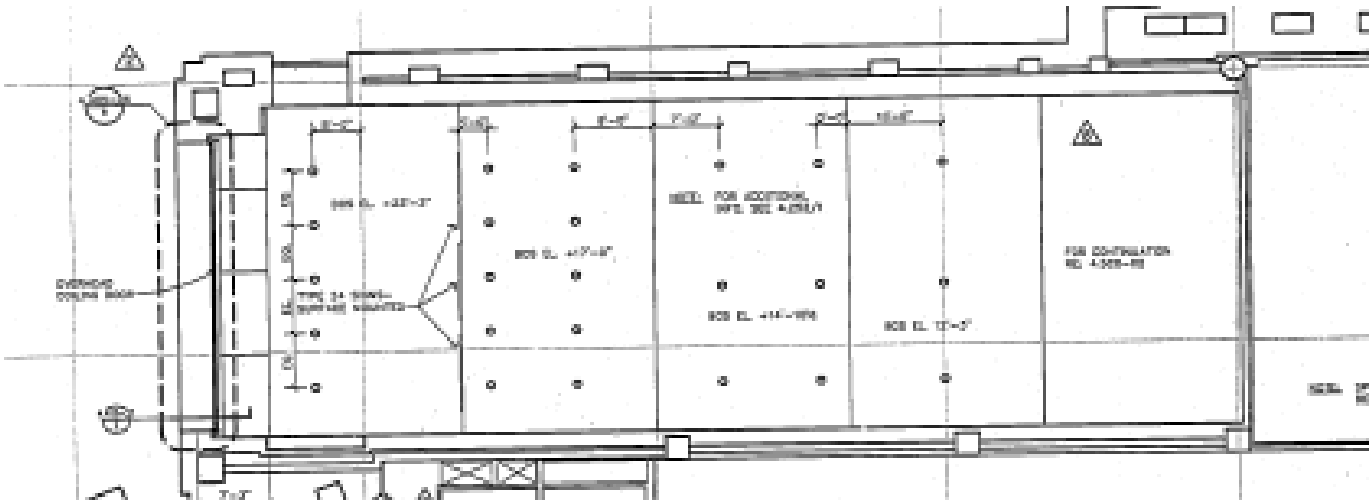

Figure 5: 14th Street North Ramp Reflected Ceiling Plan – Concourse Level

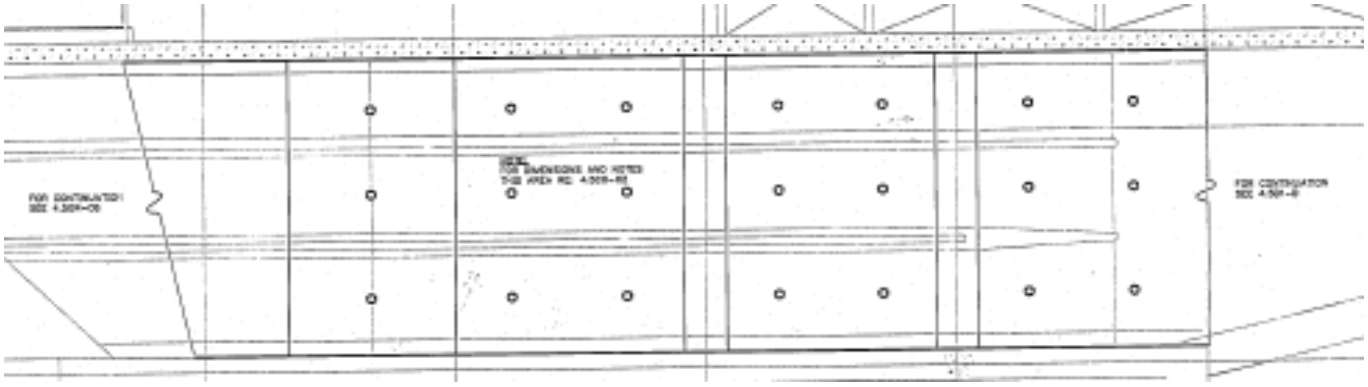

Figure 6: 14th Street South Ramp Reflected Ceiling Plan – B1 Level

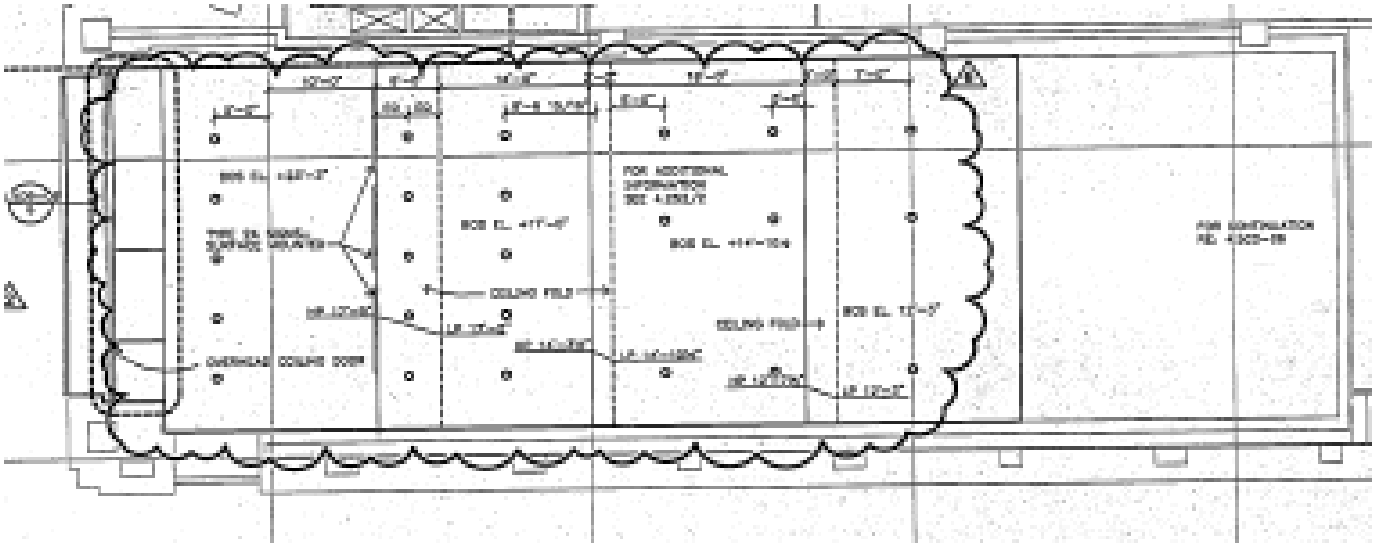

Figure 7: 14th Street South Ramp Reflected Ceiling Plan – Concourse Level

Picture 1: Typical Existing Framing – Plaster Ceiling underside

Picture 2: Typical existing framing – sagging ceiling at North Ramp

Picture 3: Typical existing framing – sagging ceiling at North Ramp

Other pictures to come with the final structural assessment report on Monday